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National Telecommunications and Information Administration
Office of Spectrum Management
Via Regulations.gov

Comments on RFC -- Development of a National Spectrum Strategy
NTIA-2023-0003
Docket Number: 230308-0068

Marcus Spectrum Solutions LLC, "MSS", is pleased to submit these comments to NTIA on the Development of a National Spectrum Strategy. MSS is the consulting practice of Michael J. Marcus, Sc.D., F-IEEE a retired FCC senior executive with experience in technical spectrum management. As an FCC official he proposed and managed several key spectrum policy rulemakings and worked closely with NTIA staff and IRAC members in these proceedings:

- Docket 81-413 – created unlicensed use of the 900, 2400, and 5700 MHz ISM bands and the foundation of today's Wi-Fi and Bluetooth used around the world.
- Docket 94-124 – created the unlicensed band originally in 59-64 GHz that was later expanded to 57-71 GHz and was replicated in many other countries
- Docket 02-146 – created "licensed light" bands at 71-76, 81-86, and 92-95 GHz and was also replicated in many other countries

These comments are submitted on behalf of MSS and do not necessarily represent the view of any of its clients. These comments address only the 100+ GHz aspects of the presentations of the mmWave Coalition, "mmWC" and the American Meteorological Society, "AMS" at NTIA's March 30, 2023 Listening Session. These were the only statements that addressed issues above 100 GHz.

AMS stated that enumerated bands needed for weather forecasting needed to be protected to very low levels of interference. Most were below 100 GHz. MSS fully agrees. The ones mentioned above 100 GHz were a small fraction of the present 10 such bands.[1]

mmWC stated that WRC-2000 Res. 731[2] requested studies of possible sharing between active services and passive services referencing *very low limits* on acceptable.[3] MSS

[1] mmWC only asked for one band that would be "easy to consider". *If* any of the 10 RR5.340/US246 protected passive bands (100-102 GHz, 109.5-111.8 GHz, 114.25-116 GHz, 148.5-151.5 GHz, 164-167 GHz, 182-185 GHz, 190-191.8 GHz, 200-209 GHz, 226-231.5 GHz, and 250-252 GHz) has *any* classified use, that band clearly would NOT be "easy to consider" could be excluded from consideration without any public explanation.

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assumes that AMS finds the protection limits stated in Res. 731 to be acceptable but if not, urges AMS and as well other passive satellite proponents to state what sharing limit is acceptable to them.

Among most passive satellite proponents, it appears that ANY consideration of ANY sharing under Res. 731 in ANY passive band is unacceptable and must be blocked or delayed as long as possible. This is clear from an FCC filing by NASA-funded CORF[4].

Whether or not NTIA or FCC believe there is a present need for *any* Fixed Service sharing with passive allocations above 100 GHz, a more immediate and simpler issue is highlighted by the recent CEPT policy for Terahertz Spectroscopy[5], called RDI-S in Europe has given this technology a green light under careful crafted emission limits:

> that CEPT administrations shall also designate the frequency band 116-260 GHz band for radiodetermination systems for industry automation in shielded environments (RDI-S), noting that any overlapping usage within the bands covered by RR No. 5.340 shall be on an exceptional basis when contiguous bandwidth is necessary for proper operation, taking into account *considering k, l, and m)*;

In this publicly available CEPT document on the adoption of the CEPT RDI-S policy[6], it is clear that Europe, Inc. understands that Terahertz Spectroscopy/RDI-S is a **competitiveness** issue:

> Germany supported the inclusion of RDI-S in the CEPT Report and stressed that a European-focussed approach facilitates an advantage in the competition of global industry markets. They also made clear that both the CEPT Report and the regulatory framework would stress that EU harmonisation of RDI-S shall not be understood as precedence for general allowance for use of passive bands subject to RR No. 5.340.

Terahertz Spectroscopy/RDI-S is not a communications technology. It is a technology that is almost always used indoors with focused antennas at distances of 10 cm to 1m. It typically covers spectrum from 75 GHz to 275 GHz with very low power spectral

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[2] RESOLUTION 731 (WRC-2000), Consideration by a future competent world radiocommunication conference of issues dealing with sharing and adjacent-band compatibility between passive and active services above 71 GHz https://www.itu.int/net/ITU-R/conferences/docs/ties/res-731-en.pdf

[3] The original version of Res. 731 adopted at WRC-2000 stated that the "interference criteria for passive sensors … (is) Recommendation ITU-R SA.1029" and the "protection criteria for radio astronomy … (is) Recommendation ITU-R RA.769". At WRC-19 Res. 731 was amended with new provisions above 275 GHz and the interference/protection criteria were updated to Recommendation ITU-R RS.2017 for passive sensors and Recommendations ITU-R RA.769 and ITU-R RA.1513 and Report ITU-R RA.2189 for radio astronomy.

[4] CORF *Opposition,* RM-11847, November 2019, https://webassets.nationalacademies.org/corf-filings/CORF-Comments-US246-FINAL.pdf

[5] CEPT/ECC Decision (22)03, Technical characteristics, exemption from individual licensing and free circulation and use of specific radiodetermination applications in the frequency range 116-260 GHz, 18 November 2022 https://docdb.cept.org/download/4217 at p. 5 and p. 14-16

[6] Minutes of the 61st ECC Meeting, 10 March 2023 https://cept.org/Documents/ecc/76506/ecc-23-023_minutes-of-61st-ecc-plenary-meeting at p. 8

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densities. For example, the new CEPT limit for maximum mean e.i.r.p. spectral density the 164-167 GHz RR5.340 band is -15 dBm/MHz.[7]

Improving manufacturing in US is a strategic goal of the Department of Commerce[8]:

Terahertz Spectroscopy is generally used as a true **manufacturing technology** that in many applications can be used for real time quality measurements - even on moving objects in production lines. This technology can measure key parameters of the objects to confirm whether they meet desired specifications to allow real time adjustments of the manufacturing process to meet specifications and maximize production yield and minimize rejects.

[7] These CEPT regulations include several other provisions to prevent harmful interference to passive spectrum users:

- RDI-S equipment shall not be marketed to private end customers;
- RDI-S equipment shall only be operated indoors (i.e. inside a building) or inside similarly shielded environments;
- Installers have to ensure that the device main beam is not pointing towards windows or other weak shielded parts of the shielded environment. The direction of main radiation shall be indicated on the specific radiodetermination device;
- Installers have to ensure that there are no unwanted obstacles in the main beam of the antenna in order to minimise unintentional reflections and scattering;

[8] https://www.commerce.gov/issues/manufacturing

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While NASA's Technology Transfer Program is justifiably proud about the agency's development and commercialization of this manufacturing technology[9], its spectrum staff who participates in IRAC appears to have a "Pandora's Box" view of the technology and consistently opposes it and consideration of ANY other Res. 731 issue as if Res. 731 is an illegitimate spectrum policy issue – notwithstanding it was a US proposal to WRC-2000 as an integral part of the other proposals that create most of the passive bands above 100 GHz.

MSS hopes that NTIA could clarify in a timely way whether the National Spectrum Strategy should include consideration of very careful sharing of any passive band above 100 GHz with the specified protection levels as a legitimate spectrum policy issue that was pioneered by the US WRC-2000 input.

Recent developments in Europe show that CEPT is willing to allow careful sharing if passive spectrum in the case of Terahertz Spectroscopy/RDI-S and has found a sharing criterion that is acceptable to passive satellite advocates in Europe for this technology that they feel will contribute to "competitiveness". Hopefully the US can do the same and increase it manufacturing competitiveness consistent with Department of Commerce goals.

/s/

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Director

[9] "The imaging capabilities of terahertz make it useful for a wide range of applications. It can be employed as a safer, more precise security measure than X-rays in airports and other buildings, revealing concealed weapons and (contents) of packages. Since numerous materials have specific spectral signatures revealed by terahertz radiation, it provides spectroscopic and other unique identification information useful for chemical analysis, pharmaceuticals, and explosives detection. Not only can terahertz see through an opaque pill bottle, for example, it can also reveal the chemical makeup of the pills inside. It can also provide high-resolution imaging down to 200 microns. The industrial possibilities of terahertz range from determining the uniformity of coating thickness to detecting hidden defects to ensure product quality… Terahertz systems can be used for thickness measurements of roofing material, paper and paper coatings, and coatings on films. They also can be employed for pharmaceutical applications like aseptic packaging and tablet production. Art conservationists from prestigious institutions like the Uffizi Gallery and the Louvre have used API systems to date paintings, look for pigment concentrations, and reveal frescos on walls that have been painted over. The technology has been even applied to examine the structure of pagodas in Japan, providing guidance for renovations."
NASA Technology Transfer Program, "Terahertz Tools Advance Imaging for Security, Industry", https://spinoff.nasa.gov/Spinoff2010/ps_8.html